

Miguel Costas

Curriculum Vitae, updated March 13, 2024

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Birth date: 11.28.1987



Education

- 2011–2016 **PhD. in Civil Engineering, area of Continuum Mechanics and Structural Theory**, *School of Civil Engineering*, University of A Coruña.
Doctoral thesis: *Crashworthiness analysis and design optimization of hybrid impact energy absorbers* Research stay at SIMLab (NTNU) during six months, granted by Fundación Barrié.
- 2005–2010 **MEng. in Civil Engineering (Ingeniero de Caminos, Canales y Puertos)**, *School of Civil Engineering*, University of A Coruña.
Number 11 of 95 in class. Erasmus exchange program at Syddansk Universitet (Odense, Denmark).
- 2005 **Professional degree in Music**, *Conservatory of Santiago de Compostela*.
Specialization in piano and musical analysis.

Awards

- 2016 **Extraordinary PhD. award**, *University of A Coruña*.
Yearly award to the best PhD. thesis in the field of Engineering at the University of A Coruña.
- 2016 **International PhD. mention**, *University of A Coruña*.
Awarded to PhD. projects which include a successful international collaboration and a research stay.
- 2016 **Cum laude PhD.**, *University of A Coruña*.
Awarded to PhD. theses with outstanding contributions, agreed by the committee by secret individual votes.

Work history

- 2021–Present **Associate Professor**, *Department of Structural Engineering, NTNU (Trondheim, Norway)*.
- 2021–Present **Principal engineer**, *Enodo AS (Trondheim, Norway)*.
- 2018–Present **Piano teacher and accompanist**, *Trondheim Kommunale Kulturskole and NTNU (Trondheim, Norway)*.
- 2019–2021 **Researcher**, *Centre for Advanced Structural Analysis (CASA), NTNU (Trondheim, Norway)*.
- 2017–2019 **Postdoctoral researcher**, *Centre for Advanced Structural Analysis (CASA), NTNU (Trondheim, Norway)*.
- 2016 **Postdoctoral researcher**, *Structural Mechanics group, University of A Coruña*.
- 2011–2015 **RD engineer and PhD candidate**, *Structural Mechanics group, University of A Coruña*.
- Summer 2009 **Internship**, *Port Authority of Vilagarcía de Arousa (Puertos del Estado)*.

Languages

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|------------|---|--|
| Spanish | Native | |
| Galician | Native | |
| English | Full professional proficiency | Certificate in Advanced English, Cambridge University. 2012. |
| Norwegian | Intermediate professional proficiency, level B2 | |
| French | Basic professional proficiency, level B1 | |
| Portuguese | Basic professional proficiency | |

Computation skills

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| FEM | Abaqus Standard and Explicit including user material subroutines, LS-DYNA, Ansys, SAP2000, Cosmos/M. |
| Optimization | Experience in structural optimization: DAKOTA and LS-OPT. |
| CAD | Autocad, Solidworks. |
| Programming | Python, Fortran, Bash, L ^A T _E X. |

Teaching experience

- 2024–Present **Teacher and coordinator of “EiT: Smart structural design with aluminium” (TKT4857), master programmes, NTNU.**
- 2019–Present **Teacher and coordinator of “Materials Mechanics” (TKT4135), master programmes, NTNU.**
- 2015–2018 **Teacher of “Advanced structural analysis” in the Master in Structural and Material Aerospace Engineering, School of Civil Engineering, UDC.**
- 2013–2014 **Assistant in the practical training of the subject “Bridges 1”, School of Civil Engineering, UDC.**

Supervision of PhD. theses

- 2019–2023 **“Behaviour and modelling of multi-layered joints”, PhD. candidate Victor André, NTNU.**
- 2022–2025 **“Behaviour and modelling of pinned joints in steel structures subjected to dynamic loading”, PhD candidate Debora Obkircher, NTNU.**
- 2022–2025 **“Terminal ballistic effects of additively manufactured maraging steel”, PhD candidate Maisie Edwards-Mowforth, The University of Edinburgh.**
- 2022–2025 **“Robust design of crash-relevant structures”, PhD. candidate Andries Matthijs Oudes, NTNU.**
- 2022–2025 **“Mechanical testing and numerical modelling of Li-ion automotive batteries subjected to impact loading”, PhD. candidate Daniele Cioni, NTNU.**
- 2023–2026 **“Testing and simulation of thick-walled aluminium profiles under severe mechanical loadings”, PhD. candidate Eduard Teixidó, NTNU.**

Patents

- National Spanish patent no. ES 2-386-269-B1: Hybrid metal-composite system for crash energy absorption. Authors: Alberto Tielas, Isabel Álvarez, Raquel Ledo (Centro Tecnológico da Automoción de Galicia, CTAG); Miguel Costas, Luis Esteban Romera (University of A Coruña, UDC). Granted on the 11th of July 2013.

Projects and activities in collaboration with industry

UDC Collaborations from 2011 to 2016:

- [Airbus, European project] FP7-AAT-2007-RTD-1. MAAXIMUS: More affordable Aircraft Structure through Extended, Integrated and Mature Numerical Sizing, UE, 03/2008-03/2013. Years 2011-2015. Budget: 370000 €.
- [Acciona Energy, national Spanish project] UNCL13-1E-2123. Boundary layer wind tunnel for civil and aeronautical engineering applications. Spanish Ministry of Economy and Competitiveness. Year 2014. Budget: 325000 €.
- [Acciona Construction, national Spanish project] DURAPORT. New technologies for the construction of durable port infrastructure. CDTI, program FEDER-INTERCONNECTA, Spanish Ministry of Economy and Competitiveness, ref. 407. Years 2011-2012. Budget: 40000 €.
- [CTAG, regional Galician project] 09DPI-011118PR INCITE 2009. Optimum design of automobile structures and components with metallic and composite materials. Regional Counseling of Economy and Industry. Years 2009-2012. Budget: 45000 €.
- [CTAG, regional Galician project] 10DPI025CT. Hybrid-Body: structural optimization of a hybrid system for frontal impact energy absorption with experimental and numerical validation. Regional Counseling of Economy and Industry. Years 2010-2012. Budget: 46000 €.
- [Puentes y calzadas] Seismic design in linear and nonlinear regimes of the new bridge over the river Chiche, in Ecuador. Ref. 443. Year 2013. Budget: 44504.77 €.
- [Airbus] Optimization study of rear fuselage. Year 2015. Budget: 25561.26 €.
- [Airbus] Junction modeling of nonlinear frequency response of assembled structures. Extension of 2012 activities. Year 2015. Budget: 24200 €.

NTNU Collaborations from 2017 to present:

- [Hydro Extruded Solutions] Study of fibrous and recrystallised AA6005-T6 for the development of a through-thickness ductile damage regularisation model for shells. Years 2017-2018.

- [**Toyota Motor Europe**] Effect of pilot holes on the mechanical behaviour of flow-drill screw joints. Years 2017-2019.
- [**Renault**] Flow drill screw joints combining steel and cast aluminium. Years 2018-2019.
- [**Toyota Motor Europe**] Study of hybrid joints with adhesive and flow drill screws. Years 2018-2020.
- [**Hydro Extruded Solutions**] Study of friction stir welds in AA6082-T6 extruded aluminium panels. Years 2019-2021.
- [**Toyota Motor Europe**] Study of the extrusion length produced during the assembly of flow-drill screws. Years 2019-2020.
- [**Hydro Extruded Solutions**] Study of a new high-strength aluminium alloy and development and implementation of an anisotropic through-thickness ductile damage regularisation model for shells. Years 2019-2020.
- [**MX3D** and **Multiconsult**] Study of the material and structural properties of square hollow beams fabricated by wire arc additive manufacturing. Years 2020-2021.
- [**Hydro** and **Benteler**] IPN project EXPECT. Years 2021-2024.
- [**Hydro Extruded Solutions, Toyota Motor Europe, Audi, BMW, Honda, Airbus, Renault**] Calibrations, workshops, seminars and stays related to the industrial implementation of the through-thickness damage regularisation model.
- [**Audi AG**] Testing and modelling of prismatic Li-ion automotive batteries. Years 2023-2025.
- [**Hydro Extruded Solutions**] Towards an AI-driven calibration of constitutive models for aluminium alloys in an industrial context. Years 2024-2028.
- [**Hydro Extruded Solutions**] Material and component experimental testing of thick-walled profiles for side crash protection. Years 2024-2028.

Other RD projects

- [National project] DPI 2013-41893-R. OPTOPAER. Probabilistic topologic and topometric optimization of aeronautical structures in linear and nonlinear regimes. Spanish Ministry of Economy and Competitiveness. Years 2014-2016. Budget: 53240 €.
- [Regional project] GRC2013-056. Group of Competitive Reference. Regional Counseling of Culture, Education and Universities. Years 2013-2016. Budget: 259000 €.

RD fundraising – awarded projects

- [National project] PID2019-108307RB-I00. OPTIFUSE. Reliability-based crashworthiness and damage tolerant optimization of new generation fuselage structures. Spanish Ministry of Science and Innovation. Year 2020. Budget: 154000 €+ PhD contract.
- [National project] DPI2016-76934-R. OPTISAFE. Probabilistic optimization of intact and damaged aeronautical structures under dynamic and impact loading. Spanish Ministry of Economy and Competitiveness. Year 2016. Budget: 111600 €.

Publications

Research articles in JCR journals.

- V. André, M. Costas, M. Langseth, and D. Morin. Behavior and large-scale modeling of multi-sheet aluminum connections with self-piercing rivets. *Journal of Manufacturing Science and Engineering*, 145:101010, 2023.
- V. André, M. Costas, M. Langseth, and D. Morin. Neural network modelling of mechanical joints for the application in large-scale crash analyses. *International Journal of Impact Engineering*, 177:104490, 2023.
- M. Costas, M. Edwards-Mowforth, M. Kristoffersen, F. Teixeira-Dias, V. Brøtan, C.O. Paulsen, and T. Børvik. Ballistic impact resistance of additive manufactured high-strength maraging steel: an experimental study. *International Journal of Protective Structures*, 2021.
- M Costas, D. Morin, JK. Sønstabø, and M. Langseth. On the effect of pilot holes on the mechanical behaviour of flow-drill screw joints. experimental tests and mesoscale numerical simulations. *Journal of Materials Processing Technology*, 294:117133, 2021.
- J. Johannessen, OH. Johannessen, M. Costas, AH. Clausen, and JK. Sønstabø. Experimental and numerical

study of notched SHS made of different S355 steels. *Journal of Constructional Steel Research*, 182:106673, 2021.

J. Paz, M. Costas, J. Delgado, L. Romera, and J. Díaz. Energy absorption of aluminium extrusions filled with cellular materials under axial crushing: Study of the interaction effect. *Applied Sciences*, 10(23), 2020.

A. Muñoz-Ibáñez, J. Delgado-Martín, M. Costas, J. Rabuñal-Dopico, J. Alvarellos-Iglesias, and J. Canal-Vila. Pure Mode I Fracture Toughness Determination in Rocks Using a Pseudo-Compact Tension (pCT) Test Approach. *Rock Mechanics and Rock Engineering*, 53:3267–3285, 2020.

M. Kristoffersen, M. Costas, T. Koenis, V. Brøtan, C.O. Paulsen, and T. Børvik. On the ballistic perforation resistance of additive manufactured AlSi10Mg aluminium plates. *International Journal of Impact Engineering*, 137:103476, 2020.

M. Costas, D. Morin, M. de Lucio, and M. Langseth. Testing and simulation of additively manufactured AlSi10Mg components under quasi-static loading. *European Journal of Mechanics - A/Solids*, 81:103966, 2020.

M. Costas, D. Morin, O.S. Hopperstad, T. Børvik, and M. Langseth. Corrigendum to “A through-thickness damage regularisation scheme for shell elements subjected to severe bending and membrane deformations” [Journal of the Mechanics and Physics of Solids 123 (2019) 190–206]. *Journal of the Mechanics and Physics of Solids*, page 103794, 2019.

M. Costas, D. Morin, O.S. Hopperstad, T. Børvik, and M. Langseth. A through-thickness damage regularisation scheme for shell elements subjected to severe bending and membrane deformations. *Journal of the Mechanics and Physics of Solids*, 123:190 – 206, 2019.

M. Costas, D. Morin, M. Langseth, J. Díaz, and L. Romera. Static crushing of aluminium tubes filled with PET foam and a GFRP skeleton. Numerical modelling and multiobjective optimization. *International Journal of Mechanical Sciences*, 131-132:205 – 217, 2017.

M. Costas, D. Morin, M. Langseth, L. Romera, and J. Díaz. Axial crushing of aluminum extrusions filled with PET foam and GFRP. An experimental investigation. *Thin-Walled Structures*, 99:45–57, 2016.

J Paz, J Díaz, L Romera, and M Costas. Size and shape optimization of aluminum tubes with GFRP honeycomb reinforcements for crashworthy aircraft structures. *Composite Structures*, 133:499–507, 2015.

M. Cid Montoya, M. Costas, J. Díaz, L. E. Romera, and S. Hernández. A multi-objective reliability-based optimization of the crashworthiness of a metallic-GFRP impact absorber using hybrid approximations. *Structural and Multidisciplinary Optimization*, 52(4):827–843, 2015.

J. Paz, J. Díaz, L. Romera, and M. Costas. Crushing analysis and multi-objective crashworthiness optimization of GFRP honeycomb-filled energy absorption devices. *Finite Elements in Analysis and Design*, 91:30 – 39, 2014.

M. Costas, J. Díaz, L. Romera, and S. Hernández. A multi-objective surrogate-based optimization of the crashworthiness of a hybrid impact absorber. *International Journal of Mechanical Sciences*, 88:46–54, 2014.

M. Costas, J. Díaz, L. E. Romera, S. Hernández, and A. Tielas. Static and dynamic axial crushing analysis of car frontal impact hybrid absorbers. *International Journal of Impact Engineering*, 62:166–181, 2013.

Book chapters.

Jacobo Díaz and Miguel Costas. Crashworthiness. In Holm Altenbach and Andreas Öchsner, editors, *Encyclopedia of Continuum Mechanics*, Berlin, Heidelberg, 2019. Springer Berlin Heidelberg.

International conferences.

M. Edwards-Mowforth, M. Costas, M. Kristoffersen, F. Teixeira-Dias, and T. Børvik. On the ballistic impact resistance of additive manufactured maraging steel targets compared to that of cast targets. In *BSSM 17th International Conference on Advances in Experimental Mechanics, Glasgow (UK)*, 2023.

M. Edwards-Mowforth, M. Costas, M. Kristoffersen, F. Teixeira-Dias, and T. Børvik. On the ballistic impact resistance of additive manufactured maraging steel targets compared to that of cast targets. In *Additively Manufactured Ballistic Protection, FFI AMMA2023 - Additive Manufacturing for Military Applications, Oslo (Norway)*, 2023.

- M. Edwards-Mowforth, M. Costas, M. Kristoffersen, F. Teixeira-Dias, and T. Børvik. On the ballistic impact resistance of additive manufactured maraging steel targets compared to that of cast targets. In *33rd International Symposium on Ballistics - ISB 2023, Bruges (Belgium)*, 2023.
- T. Børvik, M. Costas, M. Edwards-Mowforth, and M. Kristoffersen. Additively manufactured protective structures. In *ICILSM 2022, Trondheim (Norway)*, 2022.
- R. Del Cuillo, M. Costas, V. Aune, T. Børvik, J. Artero-Guerrero, J. Pernas-Sánchez, and J. Puente. Carbon fibre composite exposed to blast loading: A preliminary study. In *ICILSM 2022, Trondheim (Norway)*, 2022.
- M. Edwards-Mowforth, S. Thompson, M. Costas, M. Kristoffersen, T. Børvik, and F. Teixeira-Días. A numerical modelling and generative deep learning approach to the ballistic impact resistance of additive manufactured maraging steel plates. In *ICILSM 2022, Trondheim (Norway)*, 2022.
- M. Edwards-Mowforth, S. Thompson, M. Costas, M. Kristoffersen, T. Børvik, and F. Teixeira-Dias. A numerical modelling and deep learning approach to the ballistic impact resistance of additive manufactured maraging steel. In *Light-Weight Armour for Defence & Security LWAG 2022, Fraunhofer (Germany)*, 2022.
- D. Morin, M. Costas, and M. Langseth. Modelling of fracture in aluminium extrusions in large scale analyses. In *Nordic LS-DYNA users' conference 2022, Gothenburg (Sweden)*, 2021.
- D. Obkircher, M. Costas, T. Børvik, and O.S. Hopperstad. Shape and size optimization of a complex extruded aluminium profile for protection of battery trays in electric vehicles. In *ECCOMAS Congress 2022, Oslo (Norway)*, 2022.
- V. André, D. Morin, M. Costas, and M. Langseth. Neural network representation of mechanical fasteners in large-scale analyses. In *13th LS-DYNA European Conference, Ulm (Germany)*, 2021.
- M. Costas, D. Morin, and M. Langseth. An experimental and numerical study on the lateral crushing of additively manufactured AISi10Mg boxes. In *European Conference on the Structural Integrity of Additively Manufactured Materials, Trondheim (Norway)*, 2019.
- M. Kristoffersen, M. Costas, C.O. Paulsen, T. Koenis, V. Brøtan, and T. Børvik. Experimental and numerical investigations of additively manufactured AISi10Mg plates subjected to ballistic perforation. In *European Conference on the Structural Integrity of Additively Manufactured Materials, Trondheim (Norway)*, 2019.
- M. Costas, D. Morin, and M. Langseth. Modelling and simulation of impact in stiffened aluminium panels using damage regularisation. In *ASIDIC2019, Aerospace Structural Impact Dynamics International Conference, Madrid (Spain)*, 2019.
- M. Costas, D. Morin, and M. Langseth. Modelling of steel-aluminium components using structural adhesive and self-piercing rivets. In *12th European LS-DYNA Conference, Koblenz (Germany)*, 2019.
- D. Morin, M. Reil, T. Berstad, M. Costas, and M. Langseth. Multi-scale numerical simulations of structural joints with flow-drill screws using a virtual material calibration. In *12th European LS-DYNA Conference, Koblenz (Germany)*, 2019.
- D. Morin, T. Berstad, M. Costas, O.S. Hopperstad, and M. Langseth. *MAT_258: A through-thickness regularization scheme for shell element analyses – application to aluminium components. In *12th European LS-DYNA Conference, Koblenz (Germany)*, 2019.
- J.K. Holmen, J. Johnsen, M. Costas, D. Morin, T. Berstad, T. Børvik, O.S. Hopperstad, and M. Langseth. Applications of *MAT_258: A through-thickness regularization model for shells. In *Dynamore Nordic Users' Conference 2018, Gothenburg (Sweden)*, 2018.
- D. Morin, J.K. Holmen, J. Johnsen, M. Costas, T. Berstad, T. Børvik, O.S. Hopperstad, and M. Langseth. Theoretical aspects of *MAT_258: A through-thickness regularization model for shells. In *Dynamore Nordic Users' Conference 2018, Gothenburg (Sweden)*, 2018.
- J. Díaz, L. E. Romera, M. Costas, and J. Paz. Reliability-based crashworthiness optimization of hybrid metal-composite energy absorption devices. In *ICCS19 - 19th International Conference on Composite Structures, Porto (Portugal)*, 2016.
- L. Romera, L. Pire, M. Costas, J. Paz, J. Díaz, and S. Hernández. Improvement of crash forces in structures using optimization tools. In *HPSM/OPTI 2016, International Conference on High Performance and Optimum Design of Structures and Materials. Siena (Italy)*, 2016.

- M. Costas, J. Díaz, L. E. Romera, D. Morin, and M. Langseth. Experimental characterization and numerical multi-objective optimization of the crashworthiness of aluminum extrusions filled with PET foam and GFRP. In *1st International Conference on Impact Loading of Structures and Materials (ICILSM), Turin (Italy)*, 2016.
- J. Díaz, L. E. Romera, J. Paz, and M. Costas. Crashworthiness optimization of metal-composite energy absorption devices. In *ICCS18 - 18th International Conference on Composite Structures, Lisbon (Portugal)*, 2015.
- L. Romera, M. Costas, J. Díaz, J. Paz, and S. Hernández. Reduction of the frontal crash peak forces in a car using size optimization tools. In *35th FISITA World Automotive Congress, Maastrich (Netherlands)*, 2014.
- J. Díaz, M. Costas, L. Romera, J. Paz, and S. Hernández. Surrogate-based multi-objective optimization of glass-fiber - steel crash absorbers. In *35th FISITA World Automotive Congress, Maastrich (Netherlands)*, 2014.
- L. Romera, S. Hernández, M. Costas, A. Baldomir, and P. Ouro. Assessment of seismic behaviour of portal bridges with double friction pendulum bearings. In *7th IABSE Symposium, Madrid (Spain)*, 2014.
- L. Romera, J. Paz, M. Costas, J. Díaz, and S. Hernández. Crashworthiness response of honeycomb metallic-GFRP energy absorption devices. In *HPSM/OPTI 2014, The 2014 International Conference on High Performance and Optimum Design of Structures and Materials*, 2014.
- M. Costas, L. Romera, J. Díaz, S. Hernández, and A. Tielas. Computational and experimental analysis of a hybrid car impact absorber. In *Computational Methods and Experimental Measurements XVI, WIT Press, C.A. Brebbia, G. M. Carlomagno and S. Hernandez (eds.)*, pages 367–378, 2013.
- M. Costas, J. Díaz, L. Romera, S. Hernández, and R. Ledo. Influence of welded joints on the crashworthiness response of hybrid structural elements. In *SAE 2013 World Congress and Exhibition, paper 13B-0036/2013-01-0755*, 2013.

International research stays

- Research stay from 1/10/2014 to 1/4/2015 (six months) at the Structural Impact Laboratory (NTNU, Norway) supervised by Prof. Magnus Langseth and Dr. David Morin.

Scientific advisory

- Chairman in ECCOMAS 2022, member of the organizing committee in ICILSM 2022.
- Reviewer in JCR journals *Journal of the Mechanics and Physics of Solids*, *Engineering Fracture Mechanics*, *European Journal of Mechanics A/Solids*, *International Journal of Impact Engineering*, *International Journal of Mechanical Sciences*, *Materials and Design*, *Journal of Reinforced Plastics and Composites*, *Engineering Optimization*, *Computers and Structures*, *Composites Part B*, *Journal of Aerospace Engineering*, and *Thin-Walled Structures*.
- External advisor, Group of Structural Mechanics, University of A Coruña.
- Opponent in PhD thesis committees at: The University of Edinburgh (2019).

Other information

- Driving license. Car owner.
- Piano teacher and active professional concert pianist.